1. Consider the statement "If imitation is a form of flattery, then Ariana Grande is a huge Mariah Carey fan."

    (a) Write the converse of the above statement.

    (b) Write the contrapositive of the above statement.

2. Make up a true if-then statement whose converse is false. (Don't use any of the statements on this page.)

3. Write the negations of the following statements, **without** using the words not, no, etc. (I.e., don't just say "It is not the case that..." or other linguistic equivalent.)

    (a) "Every sucker has no chance to win, and every sucker can't stop himself from playing."

    (b) "There exists an action for which there is no opposite reaction."

4. Write down the negation of the following statement: "For every $n \in \mathbf{Z}$, there exists some $x \in \mathbf{R}$ such that $x > n$." (Ignore the question of whether the statement, or its negation, is true.)

5. For the following circuit:
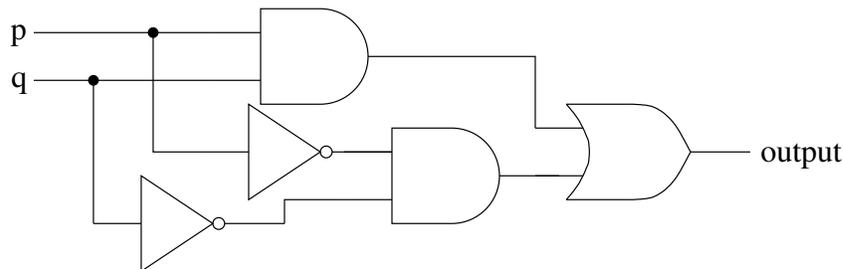
    (a) Write the output of the circuit in terms of p, q, and logical operators.

    (b) Make a truth table for the circuit.

6. It turns out that the NOR gate is universal, in that the AND, OR, and NOT gates can be built out of NOR gates. The notes on logic gates show how to build a NOT circuit using a NOR gate, so to complete the proof that the NOR gate is universal:

    (a) Show how to build an OR circuit (i.e., a circuit whose inputs are p and q and whose output is p OR q) using NOR gates. Use a truth table or logical explanation to show that your circuit has the intended effect.

    (b) Show how to build an AND circuit using NOR gates. Use a truth table or logical explanation to show that your circuit has the intended effect.